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TRANSCRIPTION OF TAPE RECORDING MADE JULY 23 AT HOLIDAY INN IN BEAUMONT OF VITE'S CONFERENCE

Present were: J. P. Vite and Robert Gara, Boyce Thompson Institute; Robert Thatcher, United States Forest Service; George Stanley and Wallace Smith, Kirby Lumber Corporation; Leroy Williamson and Don Young, Texas Forest Service.

Don Young — I thought we'd start out this morning by trying to bring the two Californians up to date on what has been done and our entomologist, Leroy Williamson, has some maps and charts that you can see what the problem has been since the inception of this particular epidemic in 1957.

Leroy Williamson — The dark circle here in red shows the area of infestation in 1958 as our epidemic reachs its real start here. It was picked up in 1957; in '58 we began to really experience our problem with it. But we had an area in 1958 of approximately 50,000 acres that had infestation. I'd just like to show you how it progressed. It moves right along very rapidly.

The area that we just looked at on the map was the area around Sour Lake; now it was spread over about 50,000 acres in this area around Sour Lake. It appears that this particular area in here seems to be our chronic sore spot. Past epidemics have all had their origin somewhere within this particular area. I believe there have been seven epidemics since 1902 and they have all had their origin somewhere in this particular area in and around Sour Lake, so this tends to be our chronic sore spot where these epidemics are getting started.

George Stanley — Just as a departure there, Leroy, I'd like to correct you that we have had two that have been east of here over in Orange and Jasper Counties, so they all haven't started here, but it's at least been in the Jasper, Orange or Hardin County areas.

Leroy Williamson — Nevertheless, you can see how that this particular information is for 1959 and '60. We had an explosion and you can see where we kept track of our infestations they're just scattered all over the place. Really wrapped up this backwoods area down here with infestations at the end of 1961.

Now at the present time, the northern edge of our known infestations is south of Lufkin and Apple Springs. Our epidemic has spread on across these two counties (Polk and Liberty) and on up into another (Angelina) county. We have infestations across this particular (the Trinity) river. Over in this area (San Jacinto and Montgomery counties) you can see a spot or two that have infestations. We are beginning now to get infestations on the other side of this (Neches) river. So we have probably close to 4 million (gross) acres right now having Southern pine beetle infestations. We have a very serious problem. It's spread over quite a large area. They (the beetles) have just spread very rapidly, that's about what this points up. We have a problem here that we're still working with and we haven't been able to get on top of the beetles to date.

George Stanley

This thing started in '57 in that triangle (Sour Lake, Saratoga, Koontze) and that's that low country.

I was going to bring this up from the standpoint of some of the developments of control. We had gone over some of these lands of ours when they (the beetles) first started (in 1957) when Bob Gara was down here. There were single tree spots when they first started on that Force and Smith Survey area. We went out and made an area control by walking over every acre and picking brood trees and chemically spraying 100% of it and bringing it (the logs) out of there before we even salvaged it. We had no break out, behind that operation.

And then each year thereafter we've made the same trip back through that same Force and Smith Survey. Every year we made an area coverage (of salvage) and it has progressively reduced the stands, like taking a selective cut out. We've reduced that stand by about 60%. The beetles have forced repeated selective cuttings. I mention that because that is the area that has been the fringe of an area to the south of this that you may see in which the landowners let the spots get bigger and the population built up a lot heavier. So what we have experienced is that it has been both area coverage which is single tree, and suddenly this year has been the most violent from the standpoint that we started off on our land this year with about 45,000 feet dead, that we knew of, after going over an overwhelming operation last year on the blow down from hurricane Carla. We ended up that, suddenly you'd wake up in here one day and you'd find as much as 100 acres of just mass kill in which your cold green trees were still green. This is the first year that we've noticed in which you could walk up and cut these green trees - it made no difference whether they had bugs in them or not - and put your

whole hand in there and absolutely have no resin. And the same thing was true in the last of '50 or early of '51, which was about a year before that thing started dying out in '50. There was something happened after Carla. Maybe we have had so much population build-up in the south end as far as beetles go, that that thing just blew this year all over East Texas. It just spewed these bugs everywhere. And I might mention this; the reason that we think a lot about this Carla business is that in the whole western part of our holdings, we went out on this area coverage. We are among the few companies that have salvage units that operate twelve months of the year picking up dead and dying timber and we turned loose our contractors to go get leaning and blown-down trees from Carla. We covered about 100,000 acres of our land before this thing (beetle buildup) tore loose this past March and we noticed that where we had done the area job from this hurricane, we were much later getting this over-wintering break-out. In other words, where we didn't cover the area is where we first started showing the over-wintering (population emergence) and we believe that a lot of these bugs over-wintered in this damaged or blown-down timber. So that on the areas we finished covering in March of this year with Carla have just really been getting these "Mass attacks." You wake up one morning and there they are, a hundred acres are dead out there. They didn't come out from over-wintering but there is a gap in there before you get into these areas. There's just so much population in the lower end down there and the winds, by the way, the hurricane was on the west side of Houston and blowing this way which would be from the southeast to northwest. So it just suddenly spread and you found beetles 50 miles from where you had ever known them to be before. Is that your observations?

Don Young

Actually, the spread from the inception has been in the northwesterly direction, before Carla ever happened. Very little to the southeast and very little to the east, but it was north and west each year. Last week I learned some spots are in Galveston County, they're on the Memorial Park in Houston, and the highly urbanized area where they use pines for ornamental trees. There is quite a serious infestation in the Houston area at the moment. It hasn't gotten into the city of Beaumont that I have heard of yet.

George, our observation was that it was 14 miles rather than 50 between known spots. We found one spot in the spring near Dam B that skipped over a longleaf area which we thought would be somewhat of a barrier which was 14 miles from the nearest known spot. I emphasize "known" there because there could have been some spots in between that we didn't know about.

George Stanley — When I flew in April, I saw this on the national forest outside of Conroe. At that time there was a long gap where there was anything known across the Trinity River. I just mentioned that as I saw they (USFS) had it long before it got reported.

Don Young — They (Southern pine beetles) were in there around Rye before the spring, though.

George Stanley — How far is it from there to Conroe?

Don Young — It's about 45 miles.

Robert Thatcher — There was an active area southeast of Livingston and below Cleveland in a previous outbreak so there may have been a carryover of population in that area, too.

George Stanley — Well, if you can visualize leaving Silsbee and flying toward our Walter Pettit area, all that Keith Company land between there and Sour Lake is nearly 100% kill on that 10,000 acres infestation. It is the worst thing you ever saw.

Don Young — Keith has one area of 2,000 acres that they feel all the pine has been killed on one spot and the type changed from pine-hardwood to hardwood.

George Stanley — We have just been fighting them in area coverage about 5 or 6 times on the Wlaker Pettit and that whole fringe in there. Now Southwestern's land comes south of us as you start toward the Sour Lake highway. They bought out Keith in that area. We are in there on the Demantia, cutting one of their tracts now.

Other than being about 100% on our own for about 4 months. We started in there about 2 months ago and there was about half of the timber that had brood trees, and now nearly all of it has brood trees. Moving farther westward to the fringe and across the Sour Lake highway, in April there wasn't too much over there. Now there are bigger spots developing--I don't know whose land--you start moving on down into the Devers area. All around our Beedle Survey has practically been wiped out. We have been for the seventh time on area coverage on Beedle. We have reduced that one about equal to five selective cuts. We are nearly to shelterwood and another cut we will be down to seed trees.

There are tremendous spots on Grayburg. Then south of Livingston there has been a big spot developing around

Champion's lands and some others on the Silas Smith Survey. In April that was one of the second largest spots. It must have been about 7 to 9 hundred acres that was solid kill; we could see over-wintering broods coming out there. Now it is well over a 1,000 acres. It is an island surrounded by rice fields down there. I'd say that whole island of timber must have about 2,000 acres of timberland. I imagine if you got on the ground there would be 90% of it affected although half of it is visibly dead.

George Stanley — From Saratoga back toward Rye, through that big country, there are no big spots. There have just been small spots. But these mass attacks have been coming up that way now for some time all through our Hamilton and Parks and Walls Surveys. All through that country you feel complacent then suddenly you wake up and have nothing. We found only one or two brown-topped trees from the air, but when you went on the ground, you could walk out 80 acres, just a solid mass of brood trees.

Don Young — That was a very common thing. I watched one spot that was six weeks from the time I first saw the beetles near Honey Island until the tops turned brown enough that you could have picked it up from the plane. I identified them on the ground in February and it was the last of April before the needles turned enough to be noticed from a plane.

George Stanley — In April and May all in Zone I north of the Santa Fe Railroad had less than 10% of total infestations. There were a few scattered spots, but the big mass population was south. During April and May we had the equivalent of about 250 men involved in control. We went on 100% of our whole mill operation plus spray crews. We had about 250 men bringing out the equivalent of about 7 million board feet a month, then. In about June, this thing started to slow down in the lower area. Then the whole area north of the Santa Fe got just as bad as the centralarea down there was as bad as it was 60 days previously, as far as spots go.

There is a big change in soil from the lower country where it is poorly drained. When it dries in the summer time, it's just as hard as concrete and in the winter time when it's wet, water stands on this heavy clay. In Zone I it's a sandy or sandy loam soil. That Segno country is entirely different country. It has been our observation that the rate of spread, once it hits this

hill country, like around Segno, the spread has been much more rapid. The epidemic may begin down in this lower country but when it does get up in this higher country it can be more violent because of the soil conditions. In June, it was obvious this thing started bursting forth in Zone I. In July it was just as bad. To give an example, in April and May we were spending 75% of our money and time in Zones III and IV and about a quarter in Zone I. Since June and July, 60% of our money and time was spent in Zone I and about 40% in Zones III and IV.

Don Young — The next step is to let Bob Thatcher tell what he has done in the way of research, what have been the accomplishments and what is proposed.

Robert Thatcher — We have been operating out of Nacogdoches now for the duration of this epidemic. Our effort has been primarily to follow the insect, its development, the population trends, any indicators of factors that may favor the insect's development or its decline. We have done as near systematic sampling as we can on infested areas on what we consider a rather limited basis because of lack of facilities and manpower to do a sufficient job of it. We have a small notion as to what the population is doing the year round. We have conducted winter studies. At the same time we have recognized the limitations of our approach because not only do we have a lack of funds and manpower to do a sufficient job but we are not getting to the total area as we would like to. As one company forester recently termed it, "We are engaged in a program of tin cup research," which doesn't make us feel too well, but nevertheless, we are doing the best we can with the facilities and manpower and situation that we find ourselves in. So, we have a setup in Nacogdoches whereby we are studying insects under artificial conditions as well as bringing in field specimen material to study the population changes that occur during the year, the impact of parasites and predators and the change in attack habits of the insects on trees. We intend to continue with this effort. It is very probable that in the very near future we will fill a vacancy in our organization at Nacogdoches with another entomologist whom we we hope will spend his full time effort on Southern pine beetle along with me so we may recognize a little more and faster progress than we have in the past. Of course it comes at a time when we are perhaps at the peak and possibly on the decline of this epidemic. Just a week ago, my division chief from New Orleans and my

project leader from Alexandria, Louisiana, were here. We were able to spend some time on the northern and western fringe areas of this epidemic. On at least 2/3 and possibly 3/4 of the infestations that we were able to examine, some of them reaching 1,000 trees in size, we saw considerable evidence that Southern pine beetles weren't doing well. The populations are coming out in very meager numbers in these areas, resin flow is showing up on the fresh cut stumps of green trees that are infested, standing trees that have been attacked have pitched out the insect. We have seen evidence of considerable invasion by both Ips and by turpentine beetle populations in these areas. In addition to this, we are experiencing a considerable build up of biological control organizms. Any tree that has been attack for a week or so is just literally alive with predators and parasites that are swarming by the thousands around the trees. So we have the feeling that physiological conditions may be improving in some of our epidemic area. It may be something that is associated with fringe and not with the center infestation zones so we need to look at this again.

I need to get into more representative areas. I have the impression that perhaps at least on the fringe areas there is a trend to levelling off and perhaps a decline which may in fact be going on. We need to be cautious in evaluating it but I think that signs are there that this may be going on. After spending some time with you fellows (Vite and Gara) out West, we anticipate within the course of the next month having a series of resin pressure guages available to us to actually measure systemically possible impact of resin pressure; its usefulness is in measure of vigor and susceptibility to bark beetle attack. It is true we don't have the background of initial infestation conditions that developed all through this epidemic. There is no way we can get these, but we certainly can follow it from here on out and then relate it possible to periods of no epidemic or problems.

We feel that there is an indication that something is happening that spells the decline of its outbreak. We are sort of working from the very limited vantage point of detective approach because one of the things that has been part of our problem in this epidemic has been the fact that most of this epidemic has occurred on private lands and we have never wished to be put in a position where we would discourage control in any way. We have essentially had to work with a different population each time

we went in the field. This has made it very difficult to make any kind of progress. We have had to piece together the best we could the information that we have been able to accumulate. I hope before long that we can make a record and publish the information available so that we know where we stand, what we have learned from all this effort and what still needs to be done. That is probably on the biggest side of the ledger, we admit it, but we had a great deal to learn.

Don Young

To elaborate on these winter conditions of our beetles: with 8 degrees Fahrenheit here in January, the lowest that has been known for 40 years, the beetles were very active two weeks later.

Have you determined how many generations we have in a year?

Robert Thatcher

This is one of the facets of the work we are engaged in right now. We have already had three complete generations from egg to adult this year since mid-February, so we anticipate about 6 generations this year. The first population required a considerably longer period of time to develop than the current population is requiring. It took roughly 60 days to go through. The second generation took approximately 45 days and the current one around 30 days. One thing that may be of interest is we have had a changing pattern of attack habit on trees. It is at extreme right now. In the winter time we normally experience a switch of movement to total stem utilization occasionally leaving 8 or 10 feet of the basal portion of the tree free from attack. These portions are subsequently attacked the following spring by Southern pine beetles. Perhaps they migrate or new beetles are attracted. We also get Ips and turpentine beetles moving in on those trees. But then in the spring and summer period, we get a transition occurring. It would appear that the same experience as with Western pine beetles is repeated down here at least on the margins of going infestations in that we have lower stem attacks, a condition associated with epidemic status. At the present time the beetles are limiting their attacks to the lower 25 feet of the stems even on the largest trees. An overlop zone starts about the top of the first log with the Ips, and then above 25 to 30 feet is a pure population of Ips from there to the top. These are the smallest Ips, Ips avulus. This population is really aggressive and we have seen evidence in recent infestation areas that have been visited both by

ourselves and Texas Forest Service that there are occasions where Ips seem to be preceding Southern pine beetles. In other cases we have turpentine beetles, apparently working before Southern pine beetles. Now it is true we have had two periods of drought this year, one being of about 5 to 6 weeks duration in May and early June. Then we had a couple of weeks of rainy weather. Now we are back into another period of extremely high temperature and dry conditions. We have been getting 95 to 100 + degree temperature and low humidity regularly for the past three weeks. So it is an extreme period in which there has been a tremendous drying out of soil conditions. We have also had a change in that broods on most of our areas are confined right to the inner bark surface now. The larval mine is confined to that area so is being concealed. The subterranean mine extended in many of our areas. In some instances there is a very irregular pattern of egg deposition. So it seems to indicate something is abnormal. There are heavy resin deposits and the initial egg gallery extends far beyond the normal which is an inch or 3/4 inch. Now it may go for 2 or 3 inches. And then there is an irregular egg deposition going on. Normal development extends out in an abnormal fashion which suggests something of a poor nutrition status in there. It may be tied in largely with resin and it may be something else. It has been suggested by one entomologist that there may be a heat reaction. We hadn't considered temperature as a lethal effect except as it involves downed logs or trees. It is possible that beetles are reacting to extremely high temperature conditions because it is our experience from taking in the material that the outer bark is extremely dry. This may have some impact on the nutritional status of the tree. A breakdown of the sugars and so on in the area where the beetles normally feed in the first instar.

Our friend, Dr. Hettrick, from the University of Florida, who is headquartered at Woodville is going to approach this temperature angle a little bit, but regretfully he is not equipped to do the job adequately with thermocouples or other proper equipment. He has been here a month. He is working almost entirely with light traps. The greatest take that he has had with respect to bark beetles has been a turpentine beetle. He gets a turpentine beetle every night just as regularly as rain. But he hasn't got enough Southern pine beetles to fill a thimble. His experience with the Southern pine

beetles was in Virginia and that was 23 years ago. It is a different situation up there. I think he needs to recognize that in order to sample Southern pine beetle populations with light traps, you must first have them flying. Since he is working in areas in which I have yet to see beetles in flight, I am questioning whether he is really sampling.

I do not wish to hang him but I feel like maybe he has not given enough attention to looking for populations that are actually on the wing, because this is an important thing. I think the use of a single light trap to sample populations of several levels, or at a single level, if you assume a positive response to a light trap, a single trap may draw beetles from all levels into this trap, whereas a situation parallel to that in California with traps at several intervals would give a truer concept of flight height and capacity. Some of these things may be ironed out yet. He is not having any success with the night flying habit of the Southern pine beetle, if one exists.

Don Young

To pin down this drought a little more, it has been approximately 3 weeks since there has been a general rain within beetle areas. We have had a good soil moisture prior to the cessation of rain. We had several showers during the latter part of June and the first part of July that covered the area so we are just now beginning to suffer from the lack of rain.

George Stanley

About resin pressures in these trees, I wanted to relate this. We sell chips to East Texas Pulp and Paper Company and we measure the moisture content every day. When I went back and looked at our records, we had not varied this moisture content until this year. When I first started noticing it was in the first of May. I saw when I first came down to Texas in '50 this same thing was happening. When you put your hand on it, there is no resin. Then I started looking at our moisture content records. It showed a very slight increase going from '49 to '50 to '51. The higher our moisture content under this contract the dryer the wood under the chemistry method. It went up slowly in May. About the first week in June it was about 55 and then it quickly went to 60 and it has been hanging on 60. That is my indicator when this thing was going to slow down this year. This has not varied at all and it is still that right today. Now, we were in the woods last week and we were cutting some absolutely green timber down in

this lower Hardin County area for a test run of the mill at Liberty. We were selecting green trees; there were no brood trees in it; we were grading them out and we were cutting them out. That tract had some evidence of the Southern pine beetle--the salvage unit had been working down there--but these we cut were absolutely green timber. You walk up there and slap your hand on them, no resin! In that southern and central area, we have yet to see a break in this moisture content. As of last week you could still walk up there and put your hand on a brood tree, green tree, you name it, it was still dry. Unless it has changed in the last week, I imagine that you can still cut them and find them that way. I wanted to mention, if this gauge pressure can be tied into moisture content then maybe the data we have had over the past 5 years may be of some value because we have been at least measuring the moisture content of these chips consistently for the last 5 years.

Robert Thatcher — I think that has been a characteristic of this outbreak. I pointed this out to these fellows when we were talking earlier in California. We have pictures and everything to show pulpwood and green cut material that has come out of this lower area all during the entire outbreak and there has been no resin flow nor moisture content beneath the bark to amount to anything. In many cases, the epidemic has been associated with tight growth in many of the areas so that we have suspected there is something abnormal perhaps in the tree physiology balance down there. In this north area, you get a different situation, I think.

George Stanley — Have you noticed this dryness before this year?

Robert Thatcher — Yes Sir. All through this outbreak. There is one thing, I think we have mentioned blue stain a little bit. We have had an apparent absence of blue stain penetration in association with this dry condition. But you are beginning to see blue stain wedges up here in this wet area where there is some growth that is good and a lot of moisture. That is something that I would expect you (Vite) would see.

Don Young — Leroy, do you have anything to supplement what Bob found in the northern and western fringes from your observations in the southern area?

Leroy Williamson — Just from field observations, I have observed this same thing. Looking at the brood trees within the last two or three weeks, when the trees were freshly attacked, one wouldn't be able to tell

there were beetles in them without this red boring dust. There was a distinct absence of pitch tubes on the trees.

As this compares to boring dust, I have been noticing that in infestations now that this has picked up an abundance of feces.

Don Young — Have you seen any evidence of this nutritional deficiency or predator increase in this southern area?

Leroy Williamson — I have been observing only in the northern area what Bob has in taking the bark from these trees that the larvae have been mining right down next to the wood.

J. P. Vité — I would like to express our appreciation that we have been invited here and certainly it will be most interesting for us. Eventually we hope that we can be of some help. However, we should explain in the beginning that we come from an area where we have to deal with pine which is a different species and with an insect which happens to be a different species. We find each time that each host-insect relations is in some respect different. So, we couldn't possibly put ourselves up as experts on the Southern pine beetle and we would like to voice that by all means.

Especially, we appreciate in this respect the kind information we got from the people today. It might lead us to think how close the problems are with respect to D. brevicomis and D. frontalis. They are very closely related. However, the difficulties you expect with frontalis here made me realize I never saw anything like that from two points. From the management point, it is something to deal with more than one generation a year and with inadequate wood moisture. I know exactly what this means resultwise. It is a full-time job to hang onto the information as to which generation (of beetle) we are on.

I think maybe another little comment that we might make is that our research project in California is based on a concept we made up for ourselves and it does not necessarily agree with other concepts completely. But I think there are mainly in bark beetle research three basic possibilities to stop and do some research on.

One might be to look in effect into the complex of the balance between natural enemies and the bark beetle population. And, of course, another one is

the insecticides and we thought one may be on the host relations to the bark beetles. But our concept is, of course, the concept of the host relations and, very naturally, we might want to over-emphasize our point. But we certainly realize the necessity to think in terms of natural control and chemical control. We don't know much about chemical control and very hard work has been done, but we realize what chemical control in the three demensions of the forest and the long term of the forest, as it would take 50 years as compared to come back each year in agriculture. Something completely different from agriculture, the agriculturalist is at least taller than his co-branch.

I personally do not believe in the biological control in bark beetles. I think very highly of biological control in defoliators which are accessible to spray, possibly, and which are, incidently, accessible to a quite larger number of parasites and predators. It is something very impressive, and we have this idea over again, to stand at a tree and see the activity as the predators start. We don't have anything better in predators than the woodpecker. Our concept is that they (predators and parasites) always naturally come too late and are too few. The build-up of the predator can only take place after sufficient material is there. And only predators which are very highly specific do the good. But now if the population goes down, our predators go down. They (the parasites) have too few generations. It's too few for two generations of the bark beetle in the West. This explains why if something would offer better balance here, it would be a tremendous opportunity. It now appears that according to our most recent data, that the rearing of predators would be difficult. They eat each other. The woodpeckers have a certain area so they don't over-populate.

Don Young

They have a limited period of activity, too. It seems to me like they just work late in the winter.

J. P. Vité

This is their winter food and they like to have a change on the menu. So this might explain only why we believe so much in the host relations. Now, another thing is we are not very good in things which are economic. We try to find out what we possibly could do in this bark beetle relationship but I am not sure that, for instance, measuring the oleoresin pressure could possibly be made economically.

Now may we in just a very few words tell what we are trying in the host relations or what we think about it. I think that all of the entomologists are pretty much aware that the host condition is responsible for any build-up of bark beetles, more than any defoliators. The host condition has to be there first for the bark beetles find suitable material. Not every susceptible material might be suitable when they can build up. The host condition is a changing thing all through the year as weather goes. When there are endemic bark beetle populations and the trees are in poor conditions for a couple of years, then nothing will happen. We don't see it (the beetle) because the population is not large enough. It is quite different if you have a fairly high population and a little movement inside of the host downward through weakness, coupling this to an outbreak. We think that some relations cannot be made too easily. For instance, the co-relations of the tree and some of the relations of the bark beetle outbreaks to the measured moisture content of the tree is sometimes difficult and not easy to correlate to resin pressure. I believe that if we have a tree which is growing very well, very healthy, and this tree develops a very large population, then a sudden drought comes along, this tree might be for a short period much more weak than a tree which barely grows, because this other tree could quickly adapt--with such as a very small crown or something like that as it is accustomed to sudden changes. We measured this up in the tree and we found that 36 year old trees had only 2 kilograms of needles and on others with a large crown and the same age had 100 kilograms of needles. Now if drought condition comes along for a few weeks, actually we can measure this. The tree with 100 kilograms of needles is using so much more up and goes down much faster than the smaller tree. This fact is complicated by the fact that the big tree might be susceptible (to insect attack), but the food material is not necessarily too different for the bark beetle. Between trees the oleoresin pressure is different in producing offspring because they have only starches and several sugars or something is going on. We don't know. This I only thought we should point out in which direction we try to go in attacking this problem.

Some other things which seem to be the same in this (Texas) situation are: moisture content, lack of blue stain development and oleoresin pressure. In pondorosa pine we have the same situation. In the outbreak area when there is drought, blue stain does not develop. If bark beetles hit too dense a

tree, they kill the tree before the blue stain can develop. In other words, if the temperature is high and the wood is dry, the blue stain can't start. Everything (mortality) is done by the beetle (only). The lack of blue stain is actually a practical indicator, i.e., if you have lack of blue stain, you can assume that the bark beetle population is moving forward tremendously. It reflects both a general poor physiological condition of the host and heavy activity of the bark beetle.

George Stanley — The key to this thing lies in the fact that when the population is large and the host is showing weakness, then is the time to wipe out the whole works. The key to this thing lies in knocking the population down as quickly as you can or else you are going to loose more and more trees.

J. P. Vité — Certainly, the principle in fighting bark beetles is what they call tree management. This is a highly theoritical thing. If you would be able to detect the trees which are infested in time and get them out in time, then you are theoritically completely safe because the trees, even if it is a long period change, they would adapt themselves to dryer conditions. But it would take them, at least in the pondorosa pine, two years to adapt. If we have the third year of drought in California, the needles become a little bit shorter and they shed a few more needles each fall. So they adapt to the condition. But the bark beetle can come any time and the trees are very susceptible in this stage. It wouldn't do anything except maybe it does a little bit to their host, but they will survive nicely and would continue to grow.

George Stanley — So if you were able to keep the population down to give the host a chance to revitalize itself, then you can keep it down in an endemic state.

Wallace Smith — Throughout the build-up of this epidemic, the trees in general have looked healthy and vigorous. They had dark green foliage and dense foliage. Now this spring we started noticing a slight yellowing of foliage and the trees were sick looking. Showers started and then immediately after this foliage built up again to dark green. It is still dark green and dense. But now we are beginning to get a needle die back. These needles are turning brown. We are coming into some kind of a needle cast condition; whether it is a fungus or whether it is just natural response to lack of moisture, I don't know. But we are noticing that all over this whole area now that we are getting lots of brown needles--die back.

J. P. Vité — If it is the older needles that are falling off, it is an adaptation to drought condition. If it is outside needles then it must be something else. This is actually nothing but an adaptation to reduced water supply. Actually too much water can kill a tree as well as too little.

George Stanley — You have made the remark about too much water can kill it just as badly as not enough water. The last epidemic came in '50 on the rip tide of a long drought. This one we have now came in on the rip tide of a wet spell of three successive years.

It is obvious the absorption and transpiration of these trees are out of balance. And although in the West you have low relative humidity which will speed up the transpiration, our problem may be reverse to this in that the absorption problem of the drought kills the small roots and the standing water will do the same thing. The absorption may be out of balance of our trees more than the transpiration in the West. But I can see there is no difference about it, it is just the intake and output is out of balance.

Don Young — Whatever causes it--it may be drought, it may be crowded condition in the stand, it may be too much hardwood or anything that reduces the vigor of the trees makes them susceptible.

J. P. Vité — I would say competition is a factor in certain areas but on so large an area, it is normally a minor cause because competition develops slowly. This doesn't come all of a sudden and the tree involved has time to adapt as the competition goes on.

Don Young — A large part of this flatwoods area we speak of and particularly where the last twoepidemics started has been known to go as long as five years when they could not be logged because of the wetness of the ground. So it isn't a temporary condition either. Of course five years maybe wouldn't crowd a stand either.

Let me get straight your statement on blue stain. Is it the shorter the blue stain extends into the heart, the more rapidly it is spreading?

J. P. Vité — If there is a low beetle population and very good host condition, blue stain will always develop. Later on if the population is large, it can overcome

everything so rapidly. The tree needs a certain amount of moisture and the blue stain needs a certain separate amount of moisture. It cannot develop. And in addition to that, if then we shall decrease the host tree's mature water condition, it uses a little bit of water what is left and even though it did it is very typical. Incidently, Bob (Thatcher) is the only one who has found that out. I think it has application to the Western pine beetles. Other beetles like Ips you will always find blue stain associated with them because they don't girdle the tree. They go parallel to it.

George Stanley — Well, that is evident here. This year we have cut the most dead timber in the most concentrated period and it has been the least damaged with blue stain and the driest timber we have cut in the past five years. So the things you are bringing out have been our experience in this logging and milling that we have had right here from May to the present date.

J. P. Vite — On second thought with regard to the moisture content of the wood, we tried to correlate moisture content of the sap wood to oleoresin pressure and we only found if a tree was already dead, then the sapwood was essentially dry. The chips might come as a sample from quite a few trees. This is good evidence. To determine if a beetle tree is susceptible or not, the moisture content cannot be used because it varies in the amount of dry material as it were, and one really doesn't know how much water is missing. It doesn't make so much difference to know how much water is in; one has to know how much water should be in. So one would have to fill up in order to measure such a thing in a beetle tree. However, with a sample taken from many trees, this should be an indicator.

George Stanley — We don't make chips totally from the slabs and edgings. I would say that 40% of all of our chips come out of round wood---the whole log. We have a system where we bring the long tree in and we cut off a whole segment or maybe throw the entire log into the chipper. Then the remaining portion of that log or maybe another log that comes through goes into the mill. Then we sort and make chips from the slabs and edgings and trimmings. Sometimes in the mill when we get a crooked log, we will throw the whole log in the slabber. So that our sample is not totally from slabs and edgings or the very outer rim of sapwood. A large percentage of our chips come from total round logs.

George Stanley — We started in on the Carla salvage last September. By March we were through with it and here comes the rise of the Southern pine beetle. In March, we moved in on the Southern pine beetle in larger quantities. I would just guess that we were still cutting green timber then to the extent of 75% green and 25% beetle. In April it moved to 50-50. In May, was 100% of our production on nothing but Southern pine beetle (killed timber). June is 100%, July is 100% and we expect August to be 100% on Southern pine beetle killed trees. We moved from March to the death rate of 100,000 board feet a week to our present level of 1,800,000 board feet per week. We started off this year with a death rate of 0, so you can see how this thing has moved from January and February. We started out on our land with only 45,000 feet dead and dying and infected, to where it is now that we have just been holding our own and building up an inventory of dead timber of 3,000,000 feet out there and have been salvaging at the rate of 7,000,000 a month for the last 90 days. This moisture content thing I'm telling you represents slabs, edgings, whole logs in the forms of chips with this moisture content going up it has been hanging around 60%.

Don Young — Some of these trees have been dead 2 or 3 weeks. Some of them are brood trees and have active broods just coming in. So you can see there is quite a difference in the moisture content of individual tree. The point is that you had to test the individual tree to see how it compared with saturation when full to determine what the moisture content was.

J. P. Vite' — Especially if you like to determine the condition of the stand your sample would have to be taken from the individual trees in the population.

George Stanley — I don't think that the so-called green timber, unaffected at the moment with any beetles, has any different moisture content or pressures than the one with the brood. The population may not have gotten there yet, but there are many of them susceptible. The whole country is susceptible.

Robert Thatcher — But what's the practical answer?

J. P. Vite' — You are finding that you have it sometimes on the small size and you have it sometimes on a geographical area. If the bark beetle reached the border line in a small outbreak as they look almost the same as we find there. The egg galleries are coated with resin and this not only produces less offspring, there are less exit gallaries. Also,

there is a higher mortality on those and the time of the generation is prolonged. It takes much longer. They don't leave the eggs they have.

Robert Thatcher — Very often, therefore, they don't even mature.

J. P. Vité — This actually was the experience on a small area as we are used to on a couple of acres, but here (in Texas) is one of 1,000,000 acres. Someone might get the feeling that this is a big flood and they compare it to the beetles you have but this is not the case.

It is a very good addition to our knowledge. The irregular gallaries are another sign. We don't know what they indicate; there is a little bit of a doubt where the population comes in. Another thing which is very interesting for us is to see a change in the attack of the tree. We observed this year with brevicomis too. We are foolish enough to believe that this wind--we had a season with much wind--had its effect, too.

George Stanley — Do you think this hurricane could spread these beetles around given a high population to begin with?

J. P. Vité — In this one would have to take a wild guess. It is a little bit in contrast to our experience. If high wind comes up, they are completely dispersed and all dislocated, but actually as soon as the beetle has a chance they go, the higher the wind the lower they go. In fact they are blown to the ground and sometimes have difficulty to get on their feet again. I think this destroys a population, but the hurricane would do something else. It would probably give some injury to the trees which cannot be seen.

Don Young — It did do that. There were many trees that were root sprung. Many were blown over. Then there may have been some other injuries that could not be seen.

J. P. Vité — The thing is, if a pine blows over, then you know this is susceptible material.

George Stanley — It can be jarred and pull the roots loose. It appears to be healthy but it is susceptible to whatever comes along.

J. P. Vité — I would say that the hurricane has something to do with it. The additional creation of a large amount of host material and besides it might spread the population. We might say from our experience with brevicomis

that what happened sometimes on much smaller areas can happen with frontals on much larger areas. I never experienced such a thing. You always have a focus to an outbreak.

The local outbreak I think is not this way that a million beetles take off from the focus and go exactly to that spot and settle down there. I think, however, this can only be explained that a focus applies with stopping someplace but each little group is normally developing on its own. It might apply here, it applied with our Ips especially and with brevicomis, this certain spot becomes attractive and then it almost draws the beetles, concentrate the beetles again. So the essence is redistribution of the population.

The use of attractant in bark beetles might come in a little bit better. I don't like to be too positive about it. The situation is that many of the pine bark beetles--this does not apply at all to other species as fir and spruce, seems to have a correlation with the host tree under endemic condition. We have to find a susceptible tree (for beetles to attack) or it doesn't survive. And for this purpose they obviously develop a mechanism to let other beetles know there is a suitable material, because the bark beetle parent cannot survive just going alone by its own in a tree. So they have to have a colonization to have offspring. This attractant which helps them to survive might as well help to destroy them one day. And to some degree it really happens with I. confusus and D. brevicomis. In ponderosa pines again it is quite different. They over populate trees and then a poor brood comes in. Two percent of the beetles only respond to attractive host trees. This is a very weak population. Then another population of 20-30% is concerned. This is a very vigorous and very aggressive population. What is left is the rest of the population.

We don't know yet. But populations differ. Again in this point we highly believe that the host material has something to do with it. That,if there is not only susceptible but suitable host material, the population might become aggressive and vigorous. But if the trees are overcome by beetles concentrating on it putting in poor conditions to breed, then the number might be yet large coming out of those trees, but they are not very aggressive. And this is what

we frequently find in a case of decline of population. We certainly wish to try this to our attractants here as we don't know at all. We can be optimistic in some respect to using it for population centers to get the trend. And if we are really lucky but we have to have quite a bit of luck, we might be able to use it to some degree and come forth with results. We have been able in these last weeks to isolate the attractants for Ips but although attractants are species specific we brought a few bottles with us. It might draw to one another; it might confuse them. With Ips we have a good hope, even under epidemic conditions, it's spectacular. We draw them in large numbers.

George Stanley — I have had the feeling that you give them enough beetles and you have the population and as weak as these trees are around here, you can absolutely wipe it out under the present conditions. It is dangerous. I think it is worse than it has been in a long time. But this business of control has been the most confusing thing to me from our people having to fight this rascal. From the standpoint that all you can do now is to get up in an airplane, go find where he has been and then try to outguess him to where he is going, to try to find the brood and you are just chasing the beetle. That's all you are doing--just like a dog chasing his tail. If you can bring in just a potful, that is highly successful. I don't think we know the total population around here, I think it would go bigger than the national debt if we got out here and sampled it as to how many beetles we have out here. I think if we could just bring in a few and even put them in a quart jar, even as many is enough to kill about 10 acres of timberland. This attraction of bringing the beetles to us is most appealing.

J. P. Vité — I think we should clarify that from our little experience the attractant would never be effective in epidemic conditions. I don't think that attractants are feasible under outbreak conditions. It has its place as a control to wipe out the beetle before an epidemic outbreak but removing the brood trees must be even a greater asset.

Robert Thatcher — If you set up enough trap trees to attract all the beetles under epidemic conditions you would essentially do the same thing as removing brood trees.

J. P. Vité — The outbreak condition is always a timely thing. If we would have here an outbreak, then the endemic

level of the beetles are all over because of this point are still not on an epidemic level, yet endemic level on, this attractant might help you to put a bell upon something if you got the first warning. I don't know if it would but yet if you got the warning you might be able to start control. With Ips we have the feeling upon the second year that we control our population. When we started out we were not quite sure how we had to do it, whether we have to put the attractant in the neighbor's land to get the beetles over there or put it on our own land and attract the neighbor's beetles. Then later in the year, the attractants of natural sources in the neighborhood forests developed obviously loose ones. We could not find one Ips on our whole forest and we had each year Ips, Ips, Ips! on several trees. So from that we take our hope that any attractants might be something.

Don Young — In '57 it might have been the answer. When the epidemic first started, it was on less than 200 acres, then we could have applied an attractant and prevented this buildup.

J. P. Vité — The beetle produces as we know the attractant in the hind gut then kicks it out with the boring dust and with the boring dust it kicks out the feces and this makes the stuff attractive. We use the attractant on our traps and the beetle is using it all the time, of course, himself and if you have an outbreak, too many beetles go astray and create natural sources of attractant. So, the higher the population, the less attractive your artificial traps become.

George Stanley — Isn't there a point in reducing this population in an epidemic to where it gets down to a certain level to where these traps and natural predators may then be of a value to letting down an epidemic? Where is the point?

J. P. Vité — This we don't know. But I think really this is a very good point you bring up. In a certain stage, for instance, if you can reduce the beetle population, the attractant is highly species specific. It just affects this type of bark beetle. It does not attract the predators. This might come in very handy and is a very complex problem. We don't believe that it is possible to produce predators enough to control an epidemic. But if you can slow down the population then at that time the predators build up and take the rest because one thing for sure in the final state nothing is as efficient as the predators. We have respect for fellows investigating the predators, after all. One has to put a little bit of emphasis on the old as well as the new.

George Stanley — This attractant system is certainly interesting from the standpoint that you can concentrate on the beetles without knocking out all your predators why this helps when it starts letting down.

J. P. Vité — You see this seems to us as a little bit of problem as using insecticides. I just learned the other day about a thing where the insect was killed off with a chemical and another insect came after that and on with the chain reaction. I think in forestry we have to work with the natural balance. The more specific you can be, the better it is. So as always if you find a technique only to kill the beetle and not his predators you certainly do something good.

Robert Thatcher — If you had a chemical that behaved in that way, we would be a whole lot better off.

J. P. Vité — Definitely. But with each lot which we remove we remove the predators and this is what some of you have seen. We check a tree on the predator and parasite population and we decide to leave it in the forest as unmerchantable, but this is impossible. This is economically impossible to apply.

Don Young — It was mentioned that predators were difficult to raise. Bob, you have had a good bit of difficulty raising the beetle itself, haven't you?

Robert Thatcher — I have. I have maintained populations now for 11 months. I have had them through 6 generations, but I couldn't hand my procedure to Peter (Vité) and tell him "this is what you do" and you carry it on from there.

George Stanley — How successful really is it in rearing these things artificially? It seems to me like this Southern pine beetle is a type of animal that the only way you can work on it is right out there in the field under his own conditions.

Robert Thatcher — I agree with you, in many respects you can gain a whole lot more from the field of study of the insect, but I think there are also things that may have an influence on the insect itself that we can only isolate by operating with it under controlled conditions and this is very difficult to do on standing trees.

J. P. Vité — I could say I agree with Bob; we advanced but are yet confused because we have been unable to do certain things under controlled conditions.

Robert Thatcher — There are basic studies that cannot be done any other way, I don't believe, unless we have unlimited funds and I don't see any forest entomologist working in that condition.

J. P. Vité — In fact we have so many difficulties with brevicomis that we actually tie everything up and close out I. confusus. Then we get a bold idea how this might well have applications.

Brevicomis in our laboratories, for instance, is not able to walk straight. Confusus walks nicely. Walks like he is drunk and he cannot walk on a string even. Most of the time the test tubes are laid on their back and spinning around. It is a very hard insect to work on.

George Stanley — It seems like one of the keys here is also the testing of just what is our population? Is that measurable? Haven't you all measured your population in the West? How many beetles do you have out here? Is that what that test was, those swinging nets, you catch them and the population?

J. P. Vité — You see, it is impossible to correlate the population but you can come close with the differential method. We catch them at randum with the nets, then we know what is in the air. This is a very low number. And then we attract them to our traps. One has to do that. If we catch many beetles in the nets and very little, comparatively speaking, in our attractant traps, then we know there must exist quite a few natural sources where the beetle goes. If it is the other way around, then we know there is a very little population and our traps catch practically all. This has been a limited study. We did not catch during a three week period one beetle in the nets which is very unusual, while we had each day 300 and more in our olfactometer. This is a very low population of course. And the moment it drops off, we know they are going to some place else.

George Stanley — Well, I see the nets and the population sample is tied into the net and olfactometer counts.

Wallace Smith — Overall this year there seems to be a definite wave of coinciding life cycles. Now that won't hold true for isolated instances, but there is a definite wave of coinciding life cycles so that at any one time you might be at a period when there is not too much activity, two weeks later maybe you have got a terrific amount. There is not as much over lapping. There is more wave of coinciding generations. We have some overlap in instances.

Robert Thatcher — Do you feel that this is a condition that is associated with this year or has there been one to occur before?

Wallace Smith — I have the impression that this occurred recently.

Robert Thatcher — During the main course of the season there is generally complete overlap, but this year we have been places to get samples and I could not get them. They just were not there. They were all in this stage or all in that stage.

Don Young — The cold spell we had held them all back and then all of a sudden when the weather turned warm, they all emerged, the first generation emerged and when they all emerged at the same time then naturally other generations emerge approximately the same time.

Wallace Smith — I don't know that they necessarily have all emerged at the same time at the same stages because there were all stages during the winter, but there was a major flux. It seemed to be in the spring because when we had this extremely warm early spring, we just had an explosion.

Don Young — We have had the experience other years in this epidemic that we have had a summer slump. In August we have failed to find any newly infested spots. The decline ran through September and October. In '61 we had that until we had right-of-way pruning and they appeared in the latter part of November and December up in the Votaw areas. We had this normal summer slump this year. Whether this situation that Bob was describing and Leroy has substantiated is a summer slump or whether it is the end of the epidemic, we wish we knew.

J. P. Vité — It is amazing to see how passive the beetle can be at times. We are used to a thing that comes, of course, with completely different weather conditions. This is repeated year after year. The pattern of the spring and early summer is the dangerous portion. Then the summer rains come in and it subsides.

Robert Thatcher — That is something that we will be interested in, I think; the period of activity in your area versus down here.

J. P. Vité — We found a different correlation that our sap goes down in the fall and in the fall we have Ips coming in--never in the spring--Ips coming into the standing trees. I am really wondering how the sap flow could apply here. If actually those trees drop during the springtime and early summer, so much that this might be correlated.

J. P. Vité — I think there is a correlation of the weather conditions and the changes in the physiological condition of the tree. Actually what we are measuring with the resin pressure is nothing but the balance of the water intake-output. Very obviously, let me explain, we have much change from the summer related to August.

Robert Thatcher — Does your resin condition decline very sharply during the late summer?

J. P. Vité — Yes. It depends very much if we have a couple of days rain which we do need in mid-September. Then the thing is to the lowest point and goes up and then the next one might come in October and it stays up. If the drought continues, it goes down in November and if the weather conditions are wrong, we get mortality in the late fall. We have, in other words, the strange thing that practically two days rain make a lot of difference. The same two days of rain in April or May don't do any good.

Don Young — We have the same situation here, I think, that many times we have seen rain come in September and we will get a flush of new growth--new candles on the pines. That is the same situation that you are explaining.

J. P. Vité — One thing might be physiologically interesting and especially difficult for the situation here. In the spring and early summer when the most growth is put on, the most new needles are produced; new needles cannot regulate the water output as good as the old, especially they transpire much more than the older needles. This is well known through measurements of the osmotic pressure, so during the period of new growth the tree needs more water and loses more water whether it wants it or not. Now, if this weak point coincides with drought condition, it might make it decidely worse.

George Stanley — Your arrival here to put some guages on some of these trees measuring this pressure is very timely because I think we are at this peak and I think this thing is on the verge of dropping off for this year. I think this would be some of the lowest pressure readings that we have had. I say we might have had some low ones here 30 days ago. I still think they are going to judge lower if you can put your hand on that tree and it is dry, why, it must be low pressure.

J. P. Vité — We don't know yet whether this method will work at all. It works very good on pondorosa pine, but the oleoresin has some acids and those acids are

tending to chrystalize and if they chrystalize faster than we get the instrument into the wood then we couldn't say a thing. Unfortunately, they sometimes are that way. We know from other pines. We cannot take any measurement on some pine and we have difficulty to take measurements on Jeffri pine.

George Stanley — Have these guages ever been used on Southern pine before?

J. P. Vité — Not those, no. The naval store industry used them on longleaf pine. They used not guages but capillary tubes from which one can estimate the pressure. This was never for a very long period of time--two days, which is plenty.

Don Young — We have had slash hit, we have had longleaf pine, and, of course, we have no shortleaf down in this southern area but it is loblolly. We have had examples of all of them except the shortleaf. Now, if it keeps going further north I imagine that we have got shortleaf that has been hit up there. I found some shortleaf in the Segno area.